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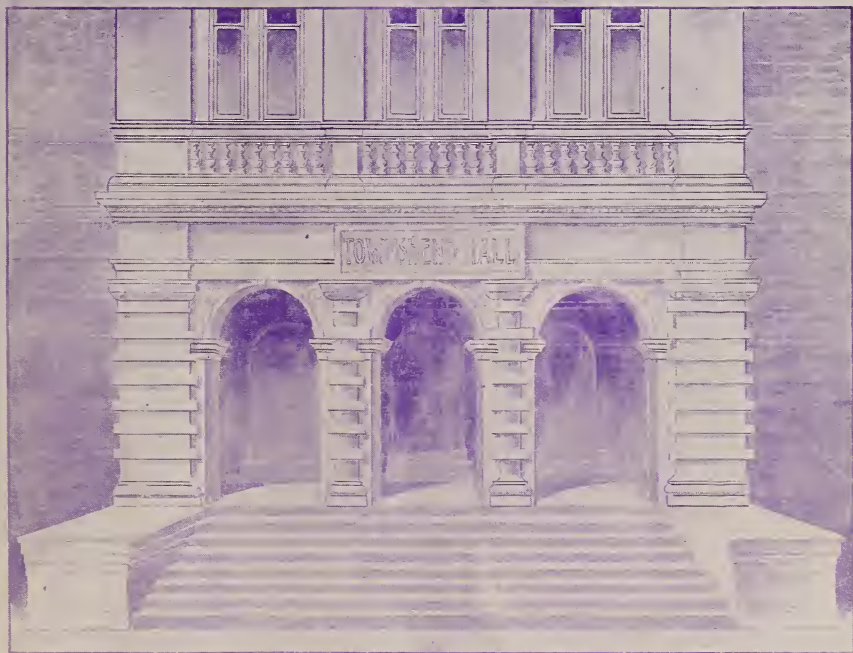
Vol. IV.

NOVEMBER, 1897.

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U. S. Department of Agric.

No. 3.

THE AGRICULTURAL STUDENT



J.S. MORRILL

N.S. TOWNSEND

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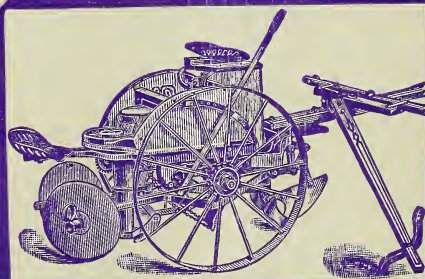
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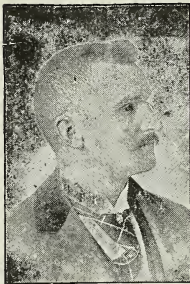
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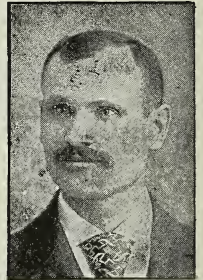
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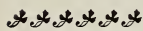
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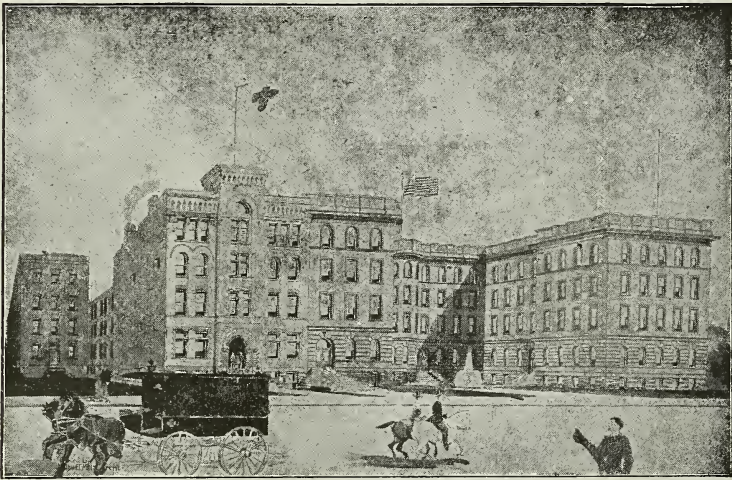
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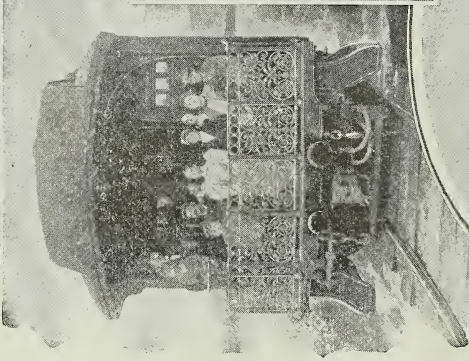
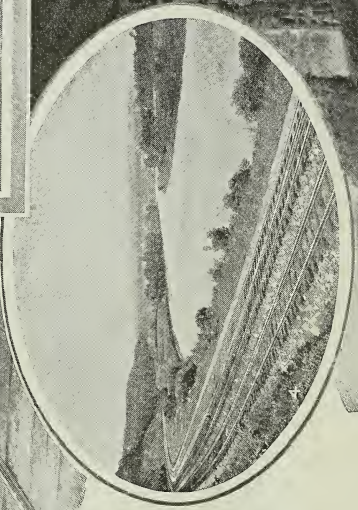
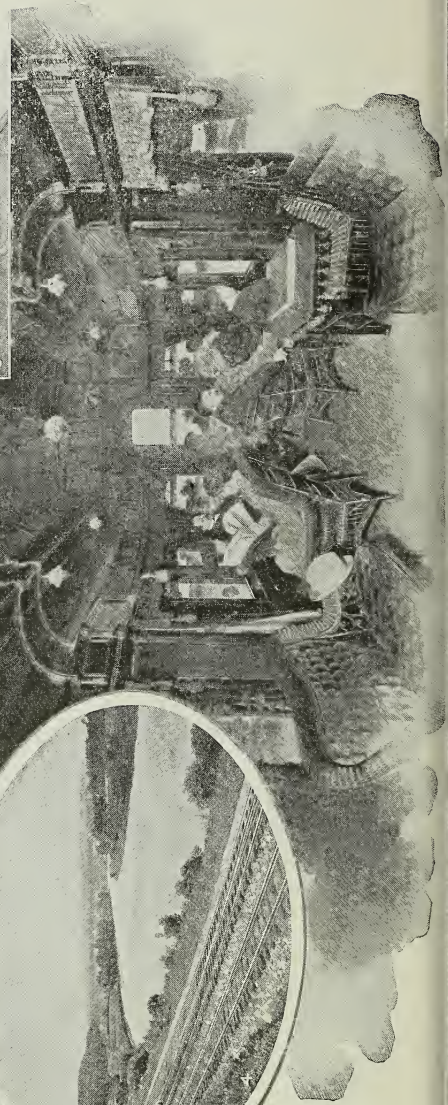
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EDITORIAL CHAT.

There seems to be a lack of energy in the society work of the University. The literary society is being replaced by the technical society to a large extent. It is all right to have the technical societies, in fact it is a sign of progress, but our literary training should not be sacrificed to the ambition to accumulate facts. The sole purpose of education is not to store the mind like a vault with "the golden treasures of truth or the sparkling gems of wisdom," but to perfect and brighten, by culture, exercise and discipline, that atom of divine essence which we call the intellect. To learn a truth is essential to the educated man, but how much more useful is he to the cause of enlightening humanity when he not only knows a thing to be so, but can stand up and tell it to others in a manner that they may grasp his meaning. The work of the general literary society should not be neglected.

By a general survey of the campus at this time one may see about how things will look in the near future. The three new buildings, Townshend Hall, the Biological building and the Gymnasium and Drill hall, are about under roof. The buildings upon the campus are now arranged in the form of a horseshoe, all facing inward. Now if our library building was just set in the center of this

group how handy it would be for everyone! The present arrangement suits quite well at present, to be sure, but some time (and that not far away) the geological and archaeological collections will need the entire space in Orton hall, and then the library must be moved elsewhere. Why not have it centrally located; a building erected for library purposes and arranged accordingly?

The University is to be congratulated upon the action taken by the faculty at a meeting held on Thursday, October 21. At this meeting the matter concerning the rules to govern the athletics of the University was brought up for discussion and reconsideration. This code of rules, put into effect last year, was very strict, and its object was 'to purify athletics at the State University. It was a very laudable purpose to be sure, but the method adopted seemed to be too violent for the athletic interests of the University and the subject matter (the foot ball team) was almost dissolved in the process of purification. There was much concern about the University when the effect of the law forbidding freshmen to play, was seen, and the injustice of the rule became apparent upon investigation. So, at the last meeting of the faculty, all freshmen who were up to the standard in their work were allowed to play foot ball. The effect was seen in the game with Otterbein two days

later. What did look like sure defeat, was almost turned to glorious victory, and all by the revision of an athletic rule. O. S. U. athletic stocks will be up for the remainder of the season.

In Memoriam.

The October number of the Farm Student's Review, published at the School of Agriculture of the University of Minnesota, contains an account of the death of its first editor-in-chief, Warren W. Pendergast. At the time of his death he was superintendent of the Northeast sub-Experiment Farm at Hutchinson, Minn. We wish to express to the parents and many friends of the deceased our sincere sympathy. The loss will be deeply felt, not only from the ranks of the young agriculturists of the West, but from the rising agriculturists and foresters of the country. His noble and useful life shows what he might have been had not death ended his career at so early a date.

Townshend.

Townshend Literary Society still flourishes. Her membership is constantly on the increase, and the standard of the work done is steadily rising, as the members gain experience. Following are the programs for the last two meetings:

October 22.

Reading Miller, C. J.
 Essay Hirshey
 Paper Miss Beattie
 Extemporaneous Speeches.
 Current Events McClelland

DEBATE.

Resolved—That market gardening is more profitable than general farming. Affirmative, Nettleton and Mills; negative, Waid and Roberts.

October 29.

Reading Mackey
 Essay Goodwin
 Extemporaneous Speeches.
 Paper Perry
 Current Events Rubens

DEBATE.

Resolved—That dairying is the most profitable branch of farming for Ohio farmers.

The American Association.

The annual meeting of "The American Association of Farmers' Institute Managers" was held at Columbus on October 27 and 28. The following program was presented, with some few changes:

Farmers' Institutes in the South....
O. Cute, Florida
 How to Manage Institutes in Sparse-
 ly Settled Communities.....
R. E. A. Leach, Manitoba
 The Value of Exhibits.....
W. L. Amos, Maryland
Geo. McKerrow, Wisconsin
 How May the Distinctly Educational
 Value of Institutes be Promoted..
Prof. John Hamilton, Penna
 What Part May the Agricultural
 Press Take in the Institute Work..
W. H. Burke, Chicago
H. F. Thurston, Chicago
 Some Deductions from Twenty Years'
 Observation of Institutes.....
C. W. Garfield, Michigan
 The Successful Institute Worker....
F. E. Dawley, New York
 How to Make Sure of Co-Operation
 From the Local Talent.....
F. W. Hodson, Ontario
 Reaching the Young People.....
K. L. Butterfield, Michigan
 Live Stock and the Institute.....
O. C. Gregg, Minnesota
 How the Institute Helps the Home
 Life of the Farmer.....
Hon. T. W. Handford, Chicago
 The Good Roads Movements and the
 Farmers' Institutes.....
Otto Dorner, Milwaukee, Wis

The meetings were held and delegates and visitors were entertained at the Great Southern Hotel. The meetings were extremely interesting and the discussions sharp and solid. The president of the association is Mr. George

McKerrow, of Madison, Wisconsin. Mr. F. W. Taylor, of Lincoln, Neb., is secretary of the association.

Columbus Horticultural Society.

The Columbus Horticultural Society held its regular monthly meeting in Horticultural hall, on October 30. The meeting proved to be unusually interesting. The reports of committees being called for, many interesting items were brought out. Mr. Gill showed specimens of several varieties of apples from Arkansas. These specimens were exceedingly well formed, of good quality, and peculiarly rich color. The Black Ben Davis, Apple of Commerce and "No. 83" were among those shown. Mr. Phelps reported some observations made through Franklin, Delaware and Licking counties, as to the condition of vegetables. Professor Lazenby showed specimens of apples from New York, among which were the Stark, Twenty Ounce and others.

Professor Lazenby then read the major paper of the meeting upon "Shade and Ornamental Trees in the State House Grounds," and made the subject general, including the shade trees of our vicinity. The discussion was very interesting and many valuable points were made.

The Rotifera of Sandusky Bay.

This is the subject of a fifty-four-page pamphlet lately published by Professor D. S. Kellicott. The work embraces some of the results of the work which Professor Kellicott has been carrying on at the Marine Laboratory at Sandusky during the past two summers. The methods of collecting are described, and a list of the species identified is given. In all 106 species of these charming animals have been identified from the bay, some of which have not been taken in this country before, and four of which are supposed to be new to science. Some have but recently been discovered in Europe, while one was described in 1893 from China.

The methods of capture, and the subsequent manipulation are described in an interesting manner. The work is valuable to scientists, as Professor Kellicott has made a special study of these animals and has described several species.

Rare Ohio Dragon Flies.

The dragon flies of the state have been mostly gathered into the University collections. The summer's search has, however, disclosed three species not before recorded. These have been added to our unique collection. Two of them at least are surprises. The first, *Libellula cyanea*, was taken by Mr. J. B. Parker at Danville; it has not heretofore been known in the interior, although common enough throughout the Atlantic border. Mr. Parker captured three and saw others, so it is not accidental, but a resident, and is certainly a beautiful addition to our fauna. It is of medium size and may be known by its blue body and colorless gauzy wings, having a pterostigma of two colors—white and black.

The second rarity, *Calithemis fasciata*, was captured by Dr. Chas Dury, of Cincinnati, near his home. The one example taken is the only one known to have occurred in the state. It was originally described from Georgia, but was found last year in Indiana by Mr. E. B. Williamson and R. C. Osburn.

The third, *Hetaeris americana*, taken first at Sugar Grove, is a slender species, reddish bronze in color with the basal third of the fore wings bright crimson and the same part of the hind wings rich brown. It is a gem.

PROF. D. S. KELLICOTT.

"It is better tew leap one rod an strike on yure feet, than tew leap tew rods and strike on yure hed. This is a well known factt."

It is better to subscribe for one paper and pay for the reading, than to read two and pay for neither.

Foot Ball.

For the first time this season a representative O. S. U. team lined up against Otterbein on October 23. All other games had been played under the unusually strict laws which govern our athletics and the very best men available to the team could not be played. We do not mean to call to account the work of the team at previous games, however, for, on the other hand, we think that the players did remarkably well, considering what odds they were playing against.

We cannot help feeling proud that we have pure athletics. We are glad that every man who holds a place upon our team is a bona fide student, carrying the required amount of work, and this work is all up to the standard. We are glad that no one holds a place on our team who is carrying but from two to five hours' work in school and is here for the express purpose of playing foot ball, and we are sorry that our clean record players may have to play some teams who are thus constituted in part.

At the beginning of the year it was the intention of the Student to publish a short review of each game. We are unable to do this at this time for want of space. Below we give the scores of the different games and a short account of the Otterbein game, the first game in which a representative O. S. U. team took part:

October 2—O. M. U. vs. O. S. U., game given to O. S. U. by default of O. M. U.

October 9—Case School vs. O. S. U., 14-0.

October 16—U. of M. vs. O. S. U., 34-0.

October 16—U. S. Barracks vs. O. S. U., 6-0.

October 23—Otterbein vs. O. S. U., 12-12.

THE OTTERBEIN GAME.

In the Otterbein game O. S. U. met one of her old-time rivals. Our game with Otterbein last season will long be remembered as one of the greatest games

in our history, and there was much speculation as to the outcome of the game on October 23.

The details of the game are as follows: Captain Hawkins won the toss and chose the east goal, giving Otterbein the ball. Captain Lloyd kicked the ball 35 yards. Saxbe caught it and brought it back 15 yards before being downed. Culbertson bucked for 3 yards, Hawkins 3 and Benedict 1. A fumble resulted in the next play and Otterbein gained possession of the pigskin. Gantz went around the end for 25 yards on the first play. Hutches tried the other end, but was tackled neatly by Scott. Gantz fumbled the ball in the next play and lost 2 yards, but an Otterbein man fell on the ball. Hutches went around the end for 2 yards. Gantz followed with a gain of 2 yards. Dempsey gained 2 and Hutches 3 yards. Coover gained 2 more yards by means of their wedge play. Gantz plunged through the line in the next play for a touch-down in six and a half minutes. Lloyd kicked a difficult goal.

Captain Hawkins on the next kick-off sent it to Otterbein's 5-yard line and Lloyd brought it back 15 yards. Hutches bucked for 4 yards, being tackled by Benedict. Gantz tried the end, but Culbertson got through and tackled him behind the line with a loss of 5 yards. Lloyd then punted 30 yards and Saxbe, receiving the ball, was downed in his tracks. Benedict bucked for 2 yards. Culbertson failed to gain. Benedict bucked again for 3 yards, making first down for O. S. U. He again cross-bucked for 6 yards, Culbertson 2, Benedict 3 and in succeeding bucks by Hawkins, Benedict and Culbertson they advanced the ball to Otterbein's 6-yard line. Benedict bucked the line and carried the ball over the line for a touch-down. Captain Hawkins kicked goal and the score stood Otterbein 6, O. S. U. 6. Time 16 minutes.

Captain Lloyd, of Otterbein kicked the ball 30 yards and the ball was brought back 10 yards by Saxbe. Culbertson fumbled but fell on the ball.

Benedict was sent through their line for 4 yards. The ball was again fumbled, but Jones fell on the ball, and it was given to Otterbein on downs.

Hutches, of Otterbein, went through the O. S. U. line for 10 yards and on the next play gained $2\frac{1}{2}$ yards. Otterbein fumbled, but retained the ball. The ball was then given to O. S. U. on downs.

Benedict cross-bucked for 7 yards, Hawkins followed with 4 yards and Culbertson gained one more, making it the first down. Culbertson again made 3 yards, Benedict 2 and then Culbertson went around the end for 16 yards. Benedict fumbled and Hutches, of Otterbein, fell on the ball. Gantz went around the end for 20 yards. Lloyd bucked $2\frac{1}{2}$ yards and time was called on the O. S. U. 30-yard line.

After the intermission the teams again lined up for the second half of 15 minutes amid great excitement. Hawkins kicked 40 yards and the ball was brought back 15 yards by Hutches, who was tackled beautifully by Jones. Gantz cross-bucked for 3 yards. Kunkle was tried for a tackle buck, but Mackey got through and downed him with a 1-yard gain. Hutches made 2 yards in two bucks. Gantz tried the end, but was downed without a gain. Lloyd fumbled and O. S. U. gained possession of the ball. Benedict bucked for 8 yards. Saxbe gained $2\frac{1}{2}$ yards by a criss-cross. Culbertson bucked for eight. Benedict bucked for $1\frac{1}{2}$ yards and then made 5 yards by an end run. Culbertson made 4 yards by the end route, Benedict 7 yards and Hawkins was sent through the line for a touch-down and then kicked goal. Score: Otterbein 6, O. S. U. 12. Time 12 minutes.

Lloyd kicked the ball to the O. S. U. 15-yard line, and it was returned 3 yards by Hawkins. Culbertson cross-bucked 4 yards and in the next play Otterbein gained the ball on a fumble. Gantz tried a buck, but could not gain, and then tried the end for a 5-yard gain. Hutchens worked the end for 6 yards, Gantz did the same for 3 more and the ball was 1

yard from the O. S. U. goal; it was carried over on the next play by Gantz and Lloyd kicked goal.

Hawkins kicked off for 35 yards. The ball was brought back 16 yards by Dempsey and the ball was in the center of the field during the remaining few minutes of play, with neither side having any apparent advantage. Time was called on the O. S. U. 23-yard line. Score: O. S. U. 12, Otterbein 12.

Otterbein.	Position.	O. S. U.
Dempsey.....	Left end.....	Scott
Coover.....	Left tackle.....	Richards
Cochrell.....	Left guard.....	Jones
Miller.....	Center.....	Segrist
Plack.....	Right guard.....	Mackey
Kunkle.....	Right tackle.....	Blose
M. Gantz....	Right end.....	Engensperger
Lott.....	Quarterback.....	Saxbe
Hutches.....	Left half.....	Benedict
		and Purdy

R. Gantz....	Right half....	Culbertson
Loyd, C.....	Fullback...	Hawkins, C.

Referee—Dinkle. Umpire—Casper.
Timekeepers—Powell and Baker. Linesmen—Jones and Sykes. Touchdowns—Benedict, Hawkins, Gantz 2. Goals—Hawkins 2, Lloyd 2.

Tuberculin Tests of O. S. U. Dairy Herd.

The O. S. U. Department of Agriculture has for a number of years had their dairy herd tested for tuberculosis as often as once each year. This year the annual test was conducted during the first part of October by Dr. White, aided by his assistants and students. The results were very gratifying indeed, as only one cow reacted, and this was a cow which had come into the herd only a few weeks previous to the time the test was made. She was at once removed to the veterinary hospital, where Dr. White proposes to make some experiments to determine the effect of the milk on guinea pigs. These experiments promise to be very interesting.

Within the last year the period of testing has been shortened somewhat. Formerly the temperatures were taken for a

period of twelve hours before injection, and for an equal period after injection. But from the results of a large number of experiments it was learned that the time could be shortened and the same results obtained. So this year Dr. White commenced at 5 o'clock p. m., and took the temperatures each hour for 5 hours. The animals were then injected and allowed to remain quiet until 6 o'clock the next morning, when the temperatures were again taken each hour until 3 o'clock p. m. This method proved perfectly satisfactory and is much more desirable, as it shortens the time considerably.

The tuberculine test, while not absolutely infallible is, nevertheless of great practical value; in fact tuberculine is the only agent known to modern medical science whereby latent cases of tuberculosis can be detected. Its deficiency is manifested mainly in aggravated cases, where it sometimes shows only a very slight reaction, if any at all; but as such cases can usually be accurately diagnosed without its aid, this fact detaches little from its practical value.

The tuberculine is simply a toxic product of the germs, and when properly prepared contains none of the tubercle bacilli, hence it cannot cause or transmit the disease to animals on which it is used.

Dairy animals which are highly fed and stables more or less, are predisposed to this disease, much more than the cattle which run at large. Experiments show that quite a large percentage of the older dairy animals in this country are affected by tuberculosis in some form.

This only proves that stringent laws should be enacted, requiring all dairy-men and stockbreeders to have their herds tested and all diseased animals disposed of. This would greatly aid in eradicating the disease and furnishing to the people a purer class of animal products. Ohio is noticeably behind many of her sister states in guarding her cattle, as well as her people, against the ravages of this disease. Several of the states

have laws prohibiting the importation of cattle into their boundaries, unless they have been tested. And the sooner Ohio makes some such laws, the better it will be, not only for the health and improvement of her cattle, but for her people also.

M. I.

The Ohio Dairy School.



CLASS OF '97.

The Department of Agriculture has recently published a small pamphlet describing the University Dairy School.

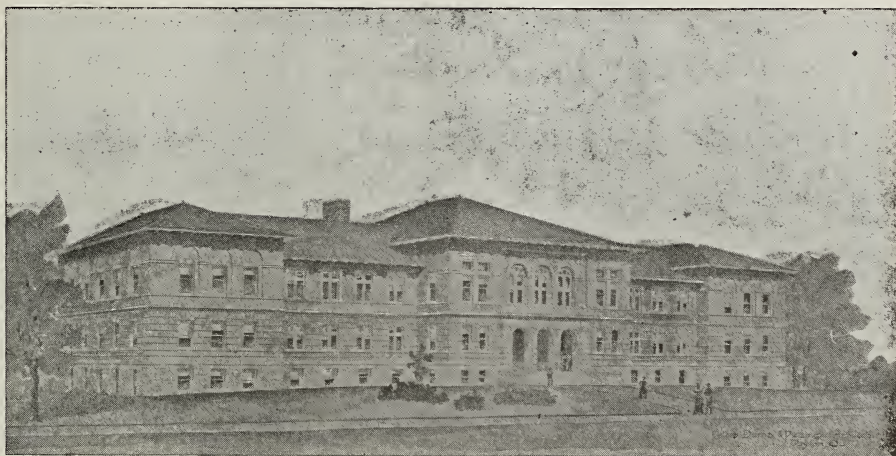
This pamphlet is designed to give a brief outline of the winter term course in Dairying which begins its fourth annual session on Wednesday, January 5th, 1898, and continues ten weeks. This special course in dairying is established to meet the wants of those who have neither the time nor means for the more extended courses. It is designed especially for those who are desirous of mastering the art of butter and cheese making or who wish to become fitted for the position of manager or superintendent of a creamery or cheese factory. Young men who are interested in general livestock farming may get much from this course that will be helpful to them, although if they have the time for it, the fuller courses of the College of Agriculture would be more desirable. The students who have taken the special course in dairying heretofore, have usually been quite successful and the outlook in this line for those who will properly prepare

themselves was never better than at the present time.

EQUIPMENT.

The work in butter and cheese making and in pasteurizing and testing milk as well as the lectures in dairying and the chemistry of milk and upon feeding, breeding, judging and management of cattle, will be given in Townshend Hall, the new Agricultural Building which the University is erecting and equipping

Detached from the main building and just opposite from the receiving room door is a boiler house which furnishes steam and power for the dairy department and which will contain the condenser, compressor and engine for a six-ton refrigerating apparatus to be used in cooling the refrigerating room, in controlling the temperature of the cheese-curing room and for pasteurizing milk. In the south end of this building is a livestock lecture room about forty feet

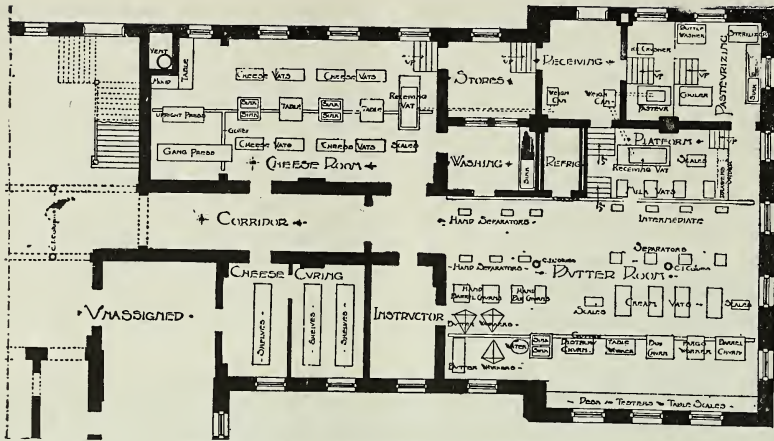


TOWNSHEND HALL, OHIO STATE UNIVERSITY.

at a cost of about \$100,000. Townshend Hall is 260 feet long and varies in width from 64 to 78 feet. Its size is best comprehended from the statement that it is more than one-eighth of a mile around the building. The rooms of the dairy department occupy the north half of the basement. As will be noted, the dairy department consists of a receiving room, a pasteurizing room, a wash room, a butter-making room, a cheese-making room, two cheese curing rooms, and an instructor's room, in all about 6000 square feet of floor space. The floors are of tile and the walls are wainscoted with enameled brick. No handsomer or more convenient suite of rooms can be found anywhere in America for this purpose than are to be found in this building.

square. One-third of this room is occupied by raised seats, the remaining floor space being used for exhibiting and judging livestock. Connected with this is a room fitted with stalls for the temporary accommodation of livestock needed for class room exercises. In this end of the building also are located the locker and bath rooms. The class rooms are on the floors above.

The lectures and laboratory work on the bacteriology of milk will be given in the new biological building, a handsome two-story structure which is being erected and equipped at a cost of about \$40,000. The Veterinary Hospital and the farm stables furnish illustrations for the lecturers on breeding, judging, management and diseases of cattle.



PLAN OF DAIRY DEPARTMENT, TOWNSHEND HALL.

Butter and Cheese Making.

(ASSISTANT PROFESSORS NOYES AND GIBBS.)

In this course a considerable part of the time is given to the laboratory or dairy room practice. This consists in testing milk as to purity, contents of butter fat, the use and care of centrifugal separators of different makes and other creamery and dairy devices, the making of butter and cheese by the most improved methods. In a word, all the essential operations of the creamery, factory, or home dairy, are repeatedly performed under the guidance and direction of the instructors until some degree of proficiency is attained. Neither is the student allowed to do this work by the rule of thumb. He is required to follow the milk from the time it enters the laboratory until the finished product leaves it, and to determine the points in the process where losses occur and reasons therefor. The saving in the loss of butter fat that can be effected by one thus trained will in any ordinary creamery more than pay his salary as compared with those who have not been properly trained.

Butter and Cheese Making.

(PROFESSOR HUNT AND ASST. PROFESSOR NOYES.)

There are lectures and recitations on methods of creaming; factors which control the thoroughness of separation, either by gravity or centrifugal force;

explanations of the continuous separation of cream; of ripening cream and testing for acidity; on the philosophy and methods of churning; the effect of temperature, acidity and richness of cream, on time and completeness of churning; on the salting, working, packing, and marketing of butter; on the fermentations of milk as affecting cheese making; on the rennet test; on the cutting, heating, milling, salting and pressing of the curd; on the curing and shipping of cheese; on the judging of butter and cheese, and the pasteurizing of milk. There are also lectures upon the construction, equipment and operation of creameries, cheese factories, dairies and milk depots. Each student is required to draw a plan of a dairy, a creamery, or a cheese factory and prepare an estimate for the equipment of the same.

The Chemistry of Milk, Butter and Cheese.

(PROFESSOR WEBER.)

The work upon this subject embraces the following:

A brief outline of the principles of chemistry and chemical nomenclature; the chemistry of carbon, hydrogen, oxygen, nitrogen and of ten other elements occurring in milk; the microscopical examination of milk, cream, and skim milk; the chemical composition of milk; the relation of specific gravity, total

solids and fats to each other; the optical method, Feser's method, etc.; Babcock's method of testing milk, cream and cheese; description and use of lactometers and creamometers.

Bacteriology.

(PROFESSOR BLEILE.)

In this subject the instruction is given both by lectures and laboratory work. The student is first taught the general facts concerning bacteria and their relation to life processes. This is followed by lectures on their special application to milk, butter and cheese.

the technical names and uses of the various parts of a boiler, engine, pump and injector. This class room work is accompanied by demonstration of the best practice in handling and caring for a steam engine and boiler; ways of firing the boiler and feeding it from a steam pump and injector; on starting, stopping and oiling the engine; on packing the piston and valve rods; on setting the valves and adjusting the bearings. Students are detailed in the boiler house in Townshend Hall on the actual care and charge of the boiler, engine, pumps and refrigerating machine.



STUDENTS AT THE SEPARATORS, OHIO STATE UNIVERSITY.

In the laboratory the students learn to prepare culture media, to make cultures and study them, and to estimate the number of bacteria in water, milk and air. Stress is laid upon the methods of pasteurization, sterilization and purification.

Care of Steam Engines and Boilers.

(PROFESSOR MAGRUDER.)

The object of this subject is to give the student a knowledge of the theory of the generation and use of steam and as much practice in the operation of a steam power plant as time will permit. The student is instructed on the physics of steam, on the mechanics and mechanism of steam engines and steam pumps and on

The Diseases of Cattle.

(PROFESSOR WHITE.)

The lectures on this subject consist of the following:

1. The anatomy of the cow with special reference to the digestion, reproduction and milk-producing organs.
2. The more common non-infectious diseases and their treatment.
3. Some of the most important infectious and contagious diseases of cattle and the methods of dealing with them.
4. Practical methods of confining and controlling cattle during operations, casting, etc., etc.

Dairy Farming.

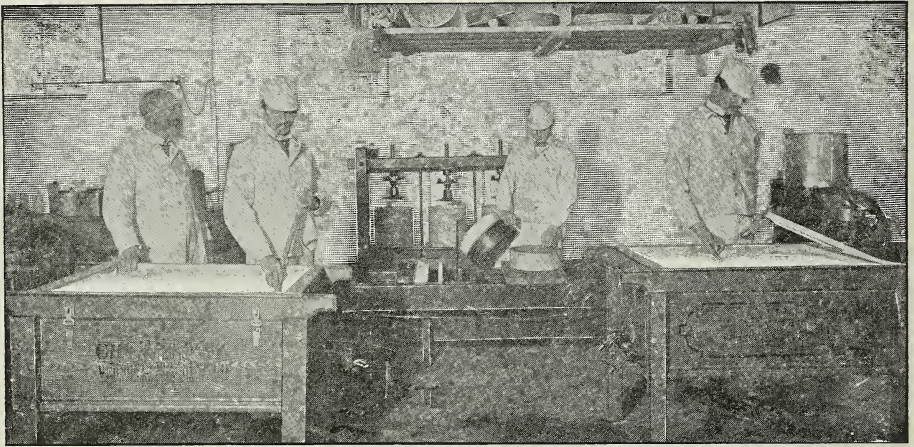
(PROFESSOR HUNT.)

Under this subject there are lectures upon the history, adaptation, care and management of different breeds of dairy cattle. By means of the score card with the animals before them, the students are taught to judge animals for dairy purposes. There are lectures on the principles of breeding and the student is required to trace and expand pedigrees and to understand the methods of recording animals as practiced by different

mar and United States history, or bring High School or other certificates for these branches. A teacher's or Boxwell certificate will be accepted. Applicants who are twenty-one or over are admitted without examination.

EXPENSES.

College Dues—Each student is required to pay an incidental fee of five dollars and a laboratory fee of ten dollars.



CHEESEMAKING AT THE OHIO STATE UNIVERSITY.

breeders' associations. There are lectures upon the character of food stuffs, the relation of the food to the animal, and the kind and quantity of food for the best milk production. The students are required to calculate digestibilities and nutritive ratios of different foods and to arrange therefrom proper feeding rations.

REQUIREMENTS FOR ADMISSION.

Any person, man or woman, who has a good common school education can enter the dairy school. The better the previous education the better the results.

Candidates must be at least fifteen years of age, and, unless they are twenty-one years old or over, must pass an examination in arithmetic, geography, gram-

mar and United States history, or bring High School or other certificates for these branches. A teacher's or Boxwell certificate will be accepted. Applicants who are twenty-one or over are admitted without examination.

Other Expenses—Books and stationery will cost from three to five dollars and two white duck suits to wear in the dairy laboratory will cost one dollar each. Rooms and board may be secured at the Dormitory on the University grounds, or in clubs and private families. The rates vary from \$3.25 to \$4.00 per week. The total expenses for the term, including fees, board, room and books, etc., need not exceed sixty dollars and may be less. Any young man of ordinary ability can earn enough more the first season to more than pay the total expenses of the term.

LOCATION.

The buildings of the Ohio State University are on the southeast portion of

the University grounds, which front east on North High street, in the city of Columbus, and extend from Eleventh avenue on the south to Woodruff avenue on the north. The campus and farm contain three hundred and forty-five acres.

For further information concerning the course in Dairying, or other work of the College of Agriculture and Domestic Science, write to the Dean of the College of Agriculture and Domestic Science, Ohio State University, Columbus, Ohio. For general information concerning the University, address Executive Office, Ohio State University, Columbus, Ohio.

Moisture in Wheat Ground.

(PROF. W. D. GIBBS.)

The prevailing severe drouth is causing great anxiety in wheat growing sections. Many are waiting for rain before sowing, while others are waiting with equal anxiety for rain to germinate seed that is already sown. This brings up the question of the preparation of the seed bed and the relation of soil moisture to crop growth with renewed interest.

It is a well-established fact that wheat requires a compact seed bed, the drier the season the more compact it should be for the reason that moisture will be drawn from deeper layers of moist soil more rapidly than in a loose seed bed, thus providing moisture for germinating and starting young plants. The value of a compact seed bed is shown in a field of wheat growing on the Ohio State University farm. This field grew a crop of clover which was harvested July 1st to 15th. During the last week in July the field was plowed six to eight inches deep and dragged, the drag, or smoother, following close behind the plow. Then it was gone over with a spring tooth harrow and a few days later rolled with a tubular roller (weighted) followed by the spring tooth harrow. Finally, just before sowing, it was rolled with a heavy iron roller. Wheat was sowed September 8th, 9th and 10th. Probably this field received more careful preparation

than the average Ohio wheat field. The two heavy rollings compacted the soil well while the spring tooth harrow worked up the surface soil, forming a protecting mulch for the moisture below.

From the date of sowing until the present time, October 9th, a period of twenty-nine days, there has been only one-fourth of an inch of rainfall, and for the entire month of September only a little more than one-half inch. Notwithstanding the extreme dry weather there is a fairly good stand of wheat on the field, and in this exceptional season it must be attributed to the careful preparation of the seed bed.

It is a curious fact that there are many spots in the field where the wheat did not germinate and the ground is bare. Seeking an explanation for this led to a study of the amount of moisture in the bare soil and in the soil growing wheat. Several determinations were made with the following results:

Surface Foot of Soil—Wheat growing, per cent. of moisture, 11.12; water per cubic foot of fresh soil, 9.32 pounds.

Surface Foot of Soil—Wheat not growing, per cent. of moisture, 8.00; water per cubic foot of fresh soil, 6.40 pounds.

It will be observed that eleven per cent. of moisture in the surface foot was sufficient to maintain the growing wheat while eight per cent. was not, showing for this soil that the smallest amount necessary for growth lies between eight and eleven per cent. The bare soil having eight per cent. of water contained six and one-half pounds of water per cubic foot of fresh soil, while the soil growing wheat contained nine and one-third pounds per cubic foot, showing the minimum amount necessary for growth to be between six and one-half and nine and one-third pounds of water per cubic foot of fresh soil.

This soil requires thirty-two per cent. of water to saturate it; thus it will be seen that the bare soil contained only one-fourth of the saturation amount, while the wheat growing soil contained

one-third of that amount, Hellriegel states that near fifty per cent., or half the saturation amount, is most favorable for the growth of ordinary crops. While one-third of the saturation amount sufficed to maintain the growing wheat, it is altogether probable that a much greater growth would have occurred had the soil contained sixteen per cent. of water, equal to fifty per cent. of the saturation amount. It may be interesting to note, also, that the soil which was too dry to germinate wheat contained one hundred and forty-one tons of water per acre in the surface foot of soil.

Farm Notes.

Lawns—The farmer never needs to be cramped for room. This is one great thing that the city or village folks cannot acquire. How much pleasure and solid comfort can be derived from a large well-kept lawn. There is a great deal of comfort entirely within reach of every farmer if he just goes after it. There is no reason, either, why the country resident should not have just as lovely lawns as the city resident. Grass grows the same in both places and a lawn costs the farmer no more than the city man, and a few hours' labor each week will keep the lawn pretty and attractive and adds so much to the cheer and pleasure of the old country home. There are no reasons why the country home should not be just as attractive and just as homelike as any city home anywhere. A neat fence, not expensive, should surround every lawn and houseyard. The grass should be mowed at regular intervals. Flowers, trees and shrubs can adorn the lawn the greater part of the year. There is no need, either, of the yard being too small. If there is any one thing the farmer has which the village folks cannot acquire it is room, and he should always enjoy it.

Walks—Winter will soon be here again, with mud and slush ankle deep. Feeding and working when conditions are such are indeed very unpleasant.

There is not much pleasure in feeding the stock when you have to wade through the mud to get to the barn. Did you ever think how little it costs or how little labor it requires to put in a few good walks to the barn or other places that are used quite frequently in doing the winter's work? If you never did, just calculate what it would cost, and then just try it, and I know you would never after that do without good walks. It is our intention to cover our whole front barnyard with cinders from four to six inches deep. The poultry houses, the horse barn, the dairy barn and the sheds will thus all be connected with good approaches and we trust we will not be afflicted with mud in any degree.

Of course every farmer has not cinders to construct walks, but cobble stones or gravel or planks are possible for every one, and good, serviceable walks can thus be cheaply and easily constructed. It is a good time now to put in these walks before the slush comes.

Reading—The farmer needs to be posted on political matters as much as any other person. It is right; keep posted. But while you are reading the political news don't forget to read up matters of an agricultural nature, for these will, nine times out of ten, bring you in more real cash than any political patronage that is likely to be handed out to you. The best way is to be well posted on your business first and last, and this never needs to be done at the expense of your citizenship.

Keep Your Best Stock.

Many farmers are in the habit of selling their best animals, as they will bring the highest price. A greater mistake cannot be made. A difference of 10 or even 25 per cent. in the price of a single animal is a small affair as compared with this difference in a whole herd. By keeping the very best to propagate from, the whole may be made of equal excellence, and in the course of a few years numerous animals might be produced

having the excellent properties that now distinguish some few of the best.

What should we say of a farmer who has several highly valuable varieties of potatoes and other kinds that are inferior, and for the sake of 10 cents extra per bushel he sells for consumption all his better varieties, and plants those that are inferior, when in consequence of this imprudent measure, his next crop will fall short 25 per cent. Everyone will condemn this course, and few, if any, are so wanting in discretion as to pursue it. Yet many take a similar course in selling their best animals and propagating from the poor. Not only is this true for animals for breeding purposes, but for work as well. Who of us do not know in our own experience of farmers who sell their best workhorses and keep the poorer. Well, the consequence is the poorer one costs a great deal more to keep each year and does less work, and in the end is the most expensive animal. The policy should have been to keep the better one and to have sold the inferior. This is true in every case.

And doubly so, I believe, when the farmer has animals for breeding purposes. There is a vast difference in our cattle in sections where much attention has been given to improvements by selecting the best, when contrasted with those where little or no attention has been paid to the subject, and as a matter of course, the best have been sold, or eaten up, because they were the fattest.

Every man that raises stock has it in his power to make improvements, and he should avail himself of all the advantages around him to turn this power to the benefit of himself and posterity.

Causes of Variation in Domesticated Animals.

No one questions the fact of variation in our domestic animals. Numerous breeds and varieties have been produced. Animals in being domesticated have been placed under different conditions of life, with numerous varieties

of uses to which they have been put, with food differing from the usual wild state, a different climate and special uses have produced the variation in our domestic animals.

Very much of this divergence is due to climatic influences, which alone are sufficiently powerful, in the changes of food and climate which necessarily follow, to account for nearly all the varieties of domestic animals. "A warm climate and a bountiful supply of nutritious food from birth to maturity produces growth and development, while a scanty supply of nutriment and a rigorous climate have a positive tendency in the opposite direction."

The horse has been dwarfed in the bleak, barren, tempestuous islands north of Scotland, with but a scanty subsistence during the long, cold winters, while the horse has developed powerfully in the rich herbage, nutritious grains and mild climate in Flanders and Normandy. With due consideration for all this, man, by selection, has been very potent in causing changes and variability in the domestic animal. Provisions of shelter, feeding and breeding have added greatly in changing and modifying the original type.

Changed conditions of life greatly modify animals in a state of domestication. If two branches of the same species were to be placed under entirely different conditions of life and left to themselves and to the operation of natural laws, in course of time a very marked difference would occur in their structure of habits.

There is a tendency in all animal life to adapt itself to conditions under which it must exist; so with domesticated animals, this tendency is potent. Offspring would have the peculiarities of the race, modified to some extent by the new conditions which environed them, and these in time would produce animals better adapted to the new order, until we should have a new race, widely different from the original, evolved by those best fitted under the new order of things and

remolded and refashioned by the changed conditions of life.

Thus we see that under changed conditions of life all animals tend to vary; that these variations may be made permanent by selection and that variation is proportionate over normal characteristics, being more complex and affecting more than one organ, any modification of one is accompanied by a modification of the other. Briefly, then, climate, food and habit are the chief causes of variation in the domestic animal.

Smuts of Sorghum.

Sorghum may not be grown in very large quantities in this State, yet multitudes of farmers have a small area for home use. It will therefore be of some interest and importance to know that it is subject to the ravages of two different species of smuts.

One of these attacks the individual grains, causing them to become somewhat enlarged and usually much elongated. The panicle, or head presents nearly the usual appearance; at least the general shape and size is but little if any altered, though careful inspection reveals the dull color and stuffy appearance characteristic of the disease. When the grain is crushed the black powder is exposed, resembling in appearance the grains of wheat affected with stinking smut. The technical name of this form of sorghum smut is *Ustilago sorghi*.

The other smut is more conspicuous, and in general appearance resembles the corn smut. It converts the whole head, or panicle into a mass of smut. It does not occur on other parts of the sorghum plant. It differs from corn smut also in exhibiting a covering of a pure white membrane when it emerges from the leaf-sheath. I need not speak of the microscopic differences between these smuts which occur on corn, wheat, oats, barley and numerous other plants. This smut—head-smut, as it may be called, to distinguish it from the grain-smut described above—has been named by the botanists *Ustilago reiliana*.

This latter smut is the more interesting of the two. It has been known since 1875, when it was first described by Kuehn, a German investigator. It was found in Egypt and Southern Europe on sorghum, on sugar-cane and on corn. In 1890 it was first reported in this country by M. Swingle and myself in Kansas, growing on sorghum raised from the infected seed. The same year it was found in New Jersey. A few weeks ago I found it in abundance in a field of sorghum in Shelby county, probably the first that has been reported for this State. It has been found growing on corn in Kansas by Mr. Norton, formerly assistant in the Kansas Experiment Station. I will be greatly obliged if persons finding this or the preceding species of sorghum-smut will send me samples by mail. I desire to study and experiment with the same.

When connected with the Kansas Experiment Station, I determined experimentally that the infection of the sorghum by these smuts was through the seed-grain. Twenty-five plots were planted, fifteen of them with infected seed. Of the fifteen, nine of them, or 60 per cent, produced smut. Since this is the case, it is right to hold that treating the seed with a proper fungicide would prevent the smut, as in case of oat-smut, barley-smut, and stinking smut of wheat. An experiment, one season only, showed that hot water was thoroughly efficient in this case as it is now universally known to be for the smut mentioned immediately above.

I might add in conclusion, that the millet-smut is a species (of course, differing from all of the foregoing) that attacks the individual grains of the head and occasionally does considerable damage to the crop of millet. I will renew my request that specimens of sorghum smuts and of millet smut be reported to me with specimens whenever found occurring, since I desire to extend my studies of these parasites.

The two cuts accompanying this paper show the stage of the sorghum head-



smut when it first emerges from the leaf-sheath (Fig. 1), still nearly covered by the waxy white membrane; and the stage when much of the smut has escaped, but the fibrous threads covered, as the black spores still remain.—W. A. Kellerman (in *Ohio Farmer*.)

Making Cheese at Home.

The following directions for making cheese at home are sent out in a bulletin from the South Carolina Experiment Station: "One of the first steps in making cheese is to curdle the milk. Acids are sometimes used; but the substance most commonly used is rennet, which is the stomach of a young calf which has been fed nothing but milk.

"The prepared rennet, sold in the form of fluid extract, powders or tablets, is more convenient than that prepared at home. A sample box of rennet tablets, costing 90 cents, will coagulate 500 gallons of milk. If the dry rennet is used it should be prepared by soaking forty-eight hours in slightly salty water. The rennet from one calf is sufficient to coagulate 200 gallons of milk and should be soaked in two gallons of water.

"The necessary apparatus for making cheese on a small scale will include—

"1st. One bucket or clean wash tub sufficiently large to hold all the milk to be used. I have found an empty fifty-pound lard can costing 25 cents an excellent vessel for the purpose.

"2d. A press may be made by taking a pole twelve or fifteen feet long and resting one end under a cleat nailed against the wall. The mould containing the cheese is placed upon a piece of plank or a strong bench so that the pole when under the cleat and over the mould is nearly horizontal. Pressure is applied by means of a box filled with small rocks hung upon the free end of the pole.

"3d. A hoop or mould in which the cheese is pressed. A very small mould may be made of a tin can by unsoldering the ends. A gallon measure with bottom removed makes a convenient hoop for a four-pound cheese. A cheese box from the grocery store may be cut down to make a cheese hoop. A mould for a five-pound brick cheese may be made from a piece of dressed plank eight inches wide and one inch thick. This should be made into a rectangular box without a top or bottom, twelve inches long and seven inches wide, outside measurements.

"4th. A cover or follower made to fit loosely inside the hoop or mould.

"5th. A long-bladed knife, which may be made out of a thin piece of wood, to cut the curd with.

"6th. A thermometer—a floating glass thermometer costing 35 cents is the best kind to use.

"To make cheese, stir the night's milk, to mix the cream well into it and add to it the morning's milk. Heat the whole to 88 degrees, stirring it gently to keep the temperature through the whole mass even.

"If coloring is to be used, about a teaspoonful to 150 pounds of milk is the proper proportion. It should be stirred into the milk as soon as it is heated. Sufficient rennet should be used to curdle the milk in from fifteen to twenty minutes. This will require three of Hansen's No. 2 tablets for each 100 pounds of milk. These should be dissolved in a teacupful of lukewarm water. The rennet should be thoroughly incorporated into the milk by stirring for a space of two minutes. The milk should then be allowed to rest until it is ready to cut. To find out when it is ready for cutting, insert the forefinger, knuckle down, into the milk at an angle of 45 degrees, touching the thumb to the surface of the milk. Move the finger upward and forward and if the curd splits clean and clears the finger, it is ready to cut. With the knife cut the curds in checks half an inch square. Stir through the curd gently with the hand or a milk skimmer. None of the curd should be larger than small hickory nuts. It may be necessary to use the knife again. With the hand free the curd that adheres to the sides and bottom of the tub, after which the temperature should be raised in the same manner in which the milk is heated to 102 or 104 degrees. This may be done by dipping the whey off the top of the tub and heating it, pouring it back and stirring gently until the required temperature is obtained. Keep the curd stirred to prevent it from becoming a solid mass again. When the curd particles seem elastic and a handful falls apart readily when gently pressed in the hand, the whey should be removed except enough to just cover the curd.

"The process from the time the rennet is added until the whey is removed should occupy about one hour. The

curd is now ready to fill into the moulds, which should be sitting near at hand upon pieces of smooth plank. When the moulds are filled the followers should be put on and a light pressure applied.

"In about half an hour the cheese will be ready for bandaging. The bandage consists of three pieces of ordinary cotton cloth. One piece is cut long enough to go around the cheese and about an inch wider than the thickness of the cheese. The other pieces are cut a little larger than necessary to cover the exposed ends of the cheese. To bandage, the cheese and cloths are dipped into a pail of water heated to 120 degrees. The bandage is wrapped nearly around the cheese and folded over the ends, after which the pieces for the ends are wrung out of hot water and laid on. If the bandage does not stick well it should be sponged down with a warm damp cloth. After the bandage is put on take a strong piece of cotton cloth and place it over the end of the cheese that was on top before. Push the mould over this and the cheese, being careful not to move the bandage. Turn the cheese upside down, put the follower on the cheese and apply pressure. Increase the pressure gradually, so that full pressure will be on in from eight to ten hours after bandaging. The cheese should remain under full pressure not less than twenty-four hours.

"After taking out of the press keep in an airy cellar, or a cool, dark room, turning over once a day and rubbing it with salt each time it is turned. The amount of salt will depend on the time the cheese is to be used. A mildly salted cheese will be ready for use in from fifteen days to three weeks. The rubbing with salt should continue five or six days. The best temperature to cure cheese in is between 65 and 70 degrees. Turn the cheese once a day for two weeks; every other day for two weeks and twice a week after that, rubbing with the palm of the hand at each turning. If much mould appears on the surface wash it with strong brine."

Winter Protection of the Peach.

Numerous experiments in protecting the peach against winter killing have been carried on at the Missouri Experiment station during the past two years. The result of these trials are reported by Prof. J. C. Whitten in Bulletin 38 of that station. The bulletin is illustrated with cuts showing the different methods employed, and is for free distribution among the peach growers of the Mississippi valley.

In this latitude, winter killing of the fruit buds of the peach is usually due to the unfavorable effects of freezing, after they have been stimulated into growth by warm weather during winter or early spring. It is seldom that the temperature drops sufficiently low to injure dormant peach buds. Peach fruit buds may safely endure a temperature of ten or twenty degrees below zero, provided they mature well in autumn, are entirely dormant, and the cold comes on gradually. Zero weather may kill fruit buds that have swollen during previous warm days, or that were not properly ripened in autumn. The early swelling and growth of the buds is due to the warmth they receive from the sun on bright days, is practically independent of root action, and may take place on warm, sunny days in winter, while the roots are frozen and dormant.

Shading or whitening peach trees to prevent their absorbing heat on sunny days, opposes growth of the buds, and is, consequently, a protective measure. Whitening the twigs and buds by spraying them with lime whitewash is, on account of its cheapness and beneficial effects, the most promising method of winter protection tried at the station. These whitened buds remained practically dormant until April, while unprotected buds swelled perceptibly during warm days late in February and early in March. Eighty per cent. of the whitened buds passed through the winter safely, while only twenty per cent. of the unwhitened buds escaped winter killing.

Whitened buds blossomed three to six days later than unwhitened ones. Thermometers covered with material the color of the peach twigs registered, during bright sunny weather, from ten to over twenty degrees higher than thermometers covered with white material of similar texture, thus indicating that whitened peach twigs might be expected to absorb much less heat than those that were not whitened.

The whitewash used was four parts of water, one part of skimmed milk and enough freshly slacked lime to make as thick a wash as could conveniently be pumped through a Bordeaux spray nozzle without clogging. This wash was sprayed on the trees by means of a bucket spray pump. The first application was made the last of December and three subsequent sprayings were necessary to keep the trees thoroughly coated until spring. The cost for material and labor is about 10 cents per tree, when done on a small scale.

Shading the trees with canvas hay covers was about as beneficial as whitening, but was more expensive.

"Baling," by drawing the branches together in a vertical bundle and covering them with coarse grass and corn stalks, protects the buds. Old trees with stiff branches cannot well be treated in this manner without injury to the branches.

"Layering," or bending down the trees in autumn and covering them with earth, has proven beneficial. Shading the trees with board sheds, enabled peach buds to survive the winter uninjured, when eighty per cent. of unprotected buds were killed. Trees protected in this way blossomed later, remained in bloom longer, set more fruit in proportion to the number of apparently perfect flowers, and held their fruit better than any other trees on the station grounds. This is the most effective means of winter protection tried at the station, but it is probably too expensive for commercial orchards.

History of the Warfare of Science With Theology.

The publication of President Andrew D. White's *History of the Warfare of Science with Theology in Christendom* puts into the hands of scientific readers a book of the greatest importance. As a record of the gradual emancipation of the human thought it ought to reach a larger audience than scientific readers alone; it ought to come into the hands of those who habitually see only the theological side of the questions discussed.

There is a fairness and candor about the book which wins one to the author's view in spite of his preconceived opposition to it. Dr. White handles theology without gloves, but always speaks reverentially of religion. He insists that theology or the science of religion has been and is being radically modified by physical science without detriment to true religion.

The author is peculiarly fitted to write a history of this struggle, having taken an active part in it during the twenty-five years in which it raged most fiercely in this country.

It is in the treatment of the subjects discussed in the first volume that the author is likely to meet the least opposition to his views, while those of the second volume will be considered as open questions by the general reader at least. While not considered as open questions by the scientific world, the subjects of several chapters, such as *From Diabolism to Hysteria*; *From Babel to Comparative Philology*; *From Divine Oracles to Higher Criticism* show that the general reader for whom the book was intended and to whom its simple, concise style will appeal, will find questions upon which he has not fully made up his mind.

These subjects are discussed not in a dogmatic manner, but in an historical manner; the author shows how the conflicts between science and theology have begun with exactly opposite points of

view. After science has established its view then there is an attempt by the opposition to compromise, and failing in this and finding that the point for which dogmatic theology has striven is of no vital importance to religion, there is the final surrender by the leaders in religious thought.

The spirit of the author may be judged from the following passage in which he speaks of the manner in which the Russian peasants hew away the ice barriers in the River Neva in order that the springtime sun may melt them more gradually and thus prevent disastrous floods:

"My work is like that of the Russian peasants; I simply try to aid in letting the light of historical truth into the decaying mass of modern thought which attaches the modern world to mediaeval conceptions of Christianity, and which still hangs around us as a most serious barrier to religious and moral advancement, and a menace to the whole moral evolution of society."

The *Farm Student's Review* comes to us each month from the School of Agriculture of the University of Minnesota. This paper is now in the second year of its existence. It is a 16-page periodical and its matter is partly of a technical nature, the remainder consisting of news items concerning the School of Agriculture. The general make-up of the paper reflects credit upon the school.

Things Printed.

Polyhymnia—A Collection of Quartets and Choruses for Male Voices. Compiled and arranged by John W. Tufts, author of "The Cecilian Series of Study and Song," and others. Cloth. Introductory price, \$1.12. Silver, Burdett & Company, Boston, New York, Chicago, Philadelphia.

This book has been prepared in answer to numerous requests from teachers, educators and directors who have felt the need of a choice collection of part songs

especially adapted to male voices. It contains an unusually large number of the finest representative selections from the works of famous composers, and thus forms an introduction to the best musical literature of the world. The compiler's mastery of the subject in general is so well known that anything prepared by him must command attention at once. His rare talent as a composer, his long and successful experience as a teacher, and the deep interest which he has always felt in the educational side of the subject, combine to give Mr. Tufts unusual fitness and ability for the preparation of musical works for the young. He has a remarkably high conception of music as an art, and his constant aims have been to cultivate a fine musical taste in young people and to raise the standard of popular music.

Polyhymnia will be sure of a cordial welcome, and, once seen, it will need no outside recommendation to all who appreciate the true and the beautiful in music.

A Few Familiar Flowers. By Margaret Morley. Boston; Ginn & Co.

A valuable book for teachers, giving them hints to make them skillful in helping children look for themselves and to think for themselves. It is a practical help in understanding the functions and uses of the various parts of the flower and the relation of its structure to its uses. It causes us to feel that the flower is alive and an individual like the rest of us. Book will be sent on receipt of 70 cents.

Philosophy of Eating. By G. J. Belows. Boston; Houghton, Mifflin & Co.

A book true to its title, covering the principles of nutrition, nutriment in food and how it is used in the body. It is a most practical handbook on the economy of food in its relation to health.

The aim of the book is to go right into the home, and the kitchen, to be read by every member of the family. The

author realizes the importance of such a work, because of the great efforts being used in the animal world to cover the principles of their feeding. And are not the principles of human eating and human life more important?

The Boston Cooking School Cook Book. By Fannie Merrill Farmer. Boston; Little, Brown & Co.

A valuable book just published and at the same time immediately used in all the leading cooking schools of America. It is a compilation of tried and tested receipts as well as a careful study of the principles of diet. When we better understand these principles we will better appreciate the fact that mankind eats to live; and to be able to do the best mental and physical work the diet should be made of the best food in the best way. Miss Farmer's work tells what is the best, and how to prepare it. It simplifies the underlying principles of all cooking, that it may be a guide to the inexperienced.

Insect Life. By Prof. J. H. Comstock. New York; D. Appleton & Co.

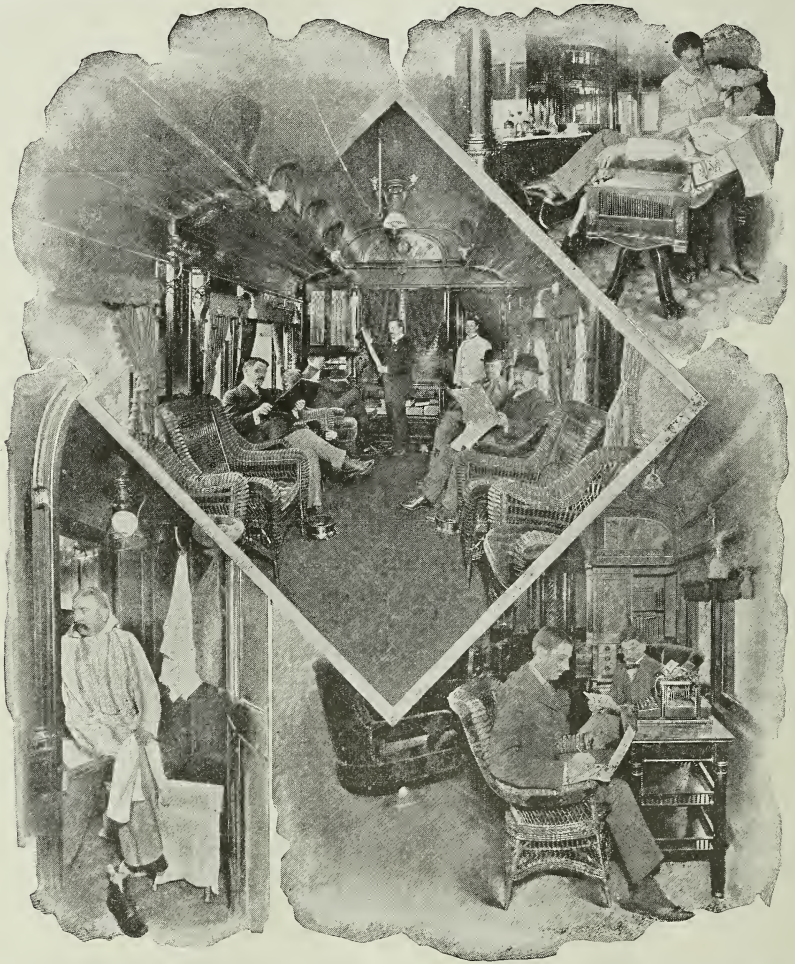
Among the recent additions to scientific literature is a book entitled "Insect Life," by Professor J. H. Comstock, of Cornell University. The work is designed for a textbook to be used in public schools. The desirability for a work of this kind has been realized for a long time, and is becoming more and more apparent with each successive year.

The book is pleasingly illustrated with numerous engravings by Mrs. Comstock, whose ability for such work is most highly appreciated.

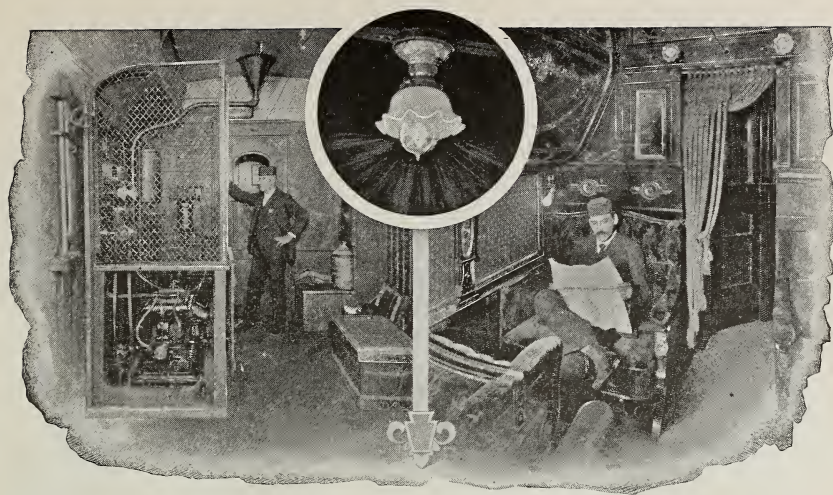
Several chapters on classification and collecting, mounting and preserving insects compose a large part of the work. Besides one chapter on "Pond Life," one on "Book Life," one on "Orchard Life," and one each on "Forest Life" and "Roadside Life," add greatly to its value and popularity. This addition to literature, by such competent authors, will be a great favorite.

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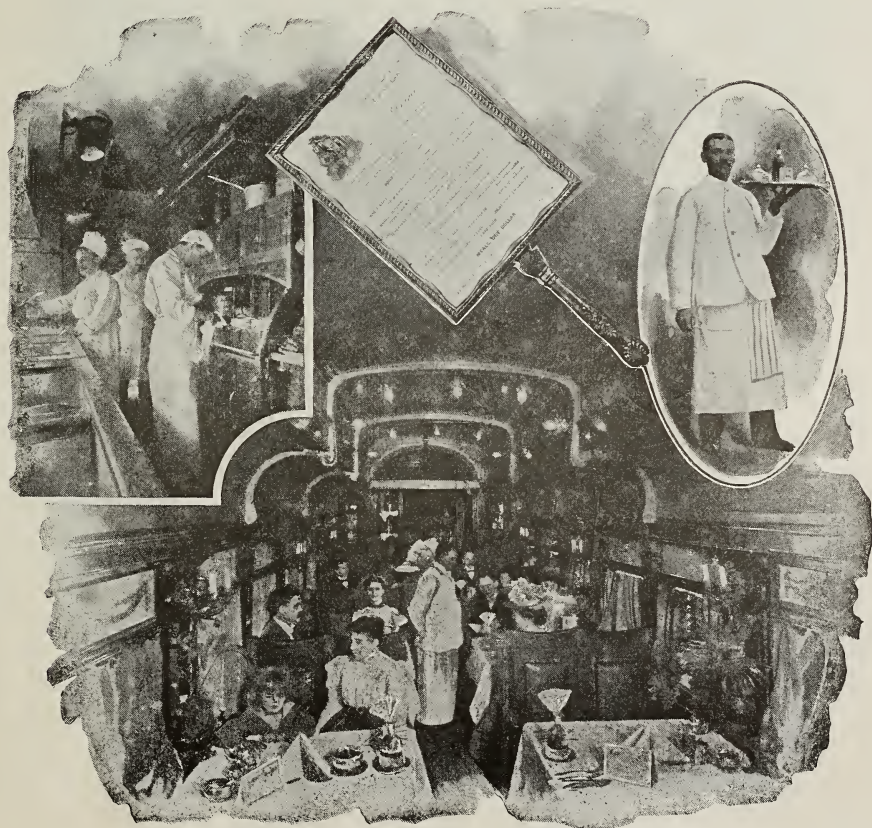
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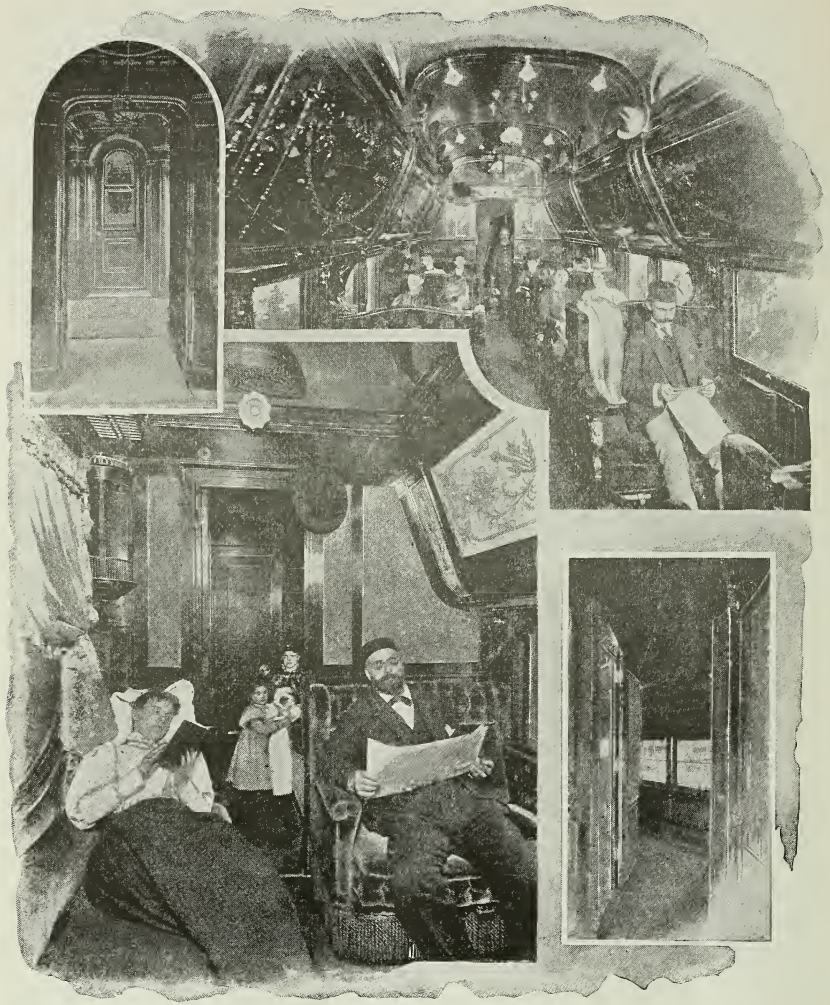


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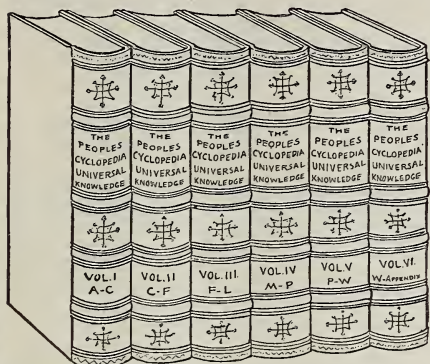


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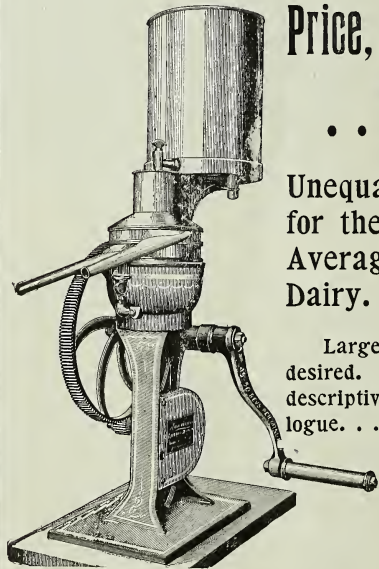
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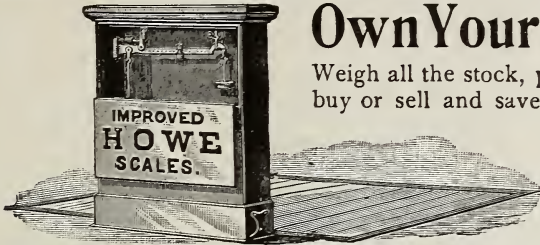
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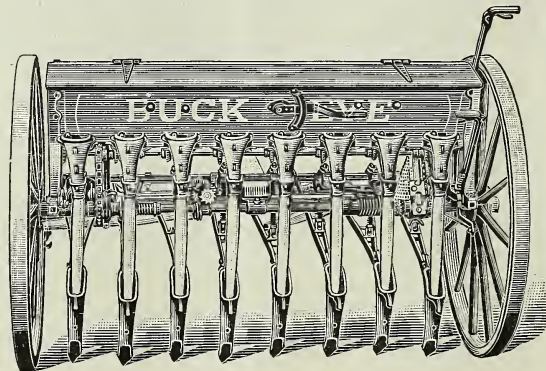
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